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The attached documents are exact copies of the European patent application described on the following page, as originally filed.

Les documents fixés à cette attestation sont conformes à la version initialement déposée de la demande de brevet européen spécifiée à la page suivante.

Patentanmeldung Nr.   Patent application No.   Demande de brevet n°

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Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
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maximise the size of a disk scheduler buffer memory within memory of a portable streaming device.

An object of the invention is to use existing memory of a portable streaming device more efficiently. A further object of the invention is to extend life cycle of a portable streaming device without modification of the existing hardware. Yet another object of the invention is to minimise the amount of necessary dedicated memory reserved for disk buffering. Furthermore, an object of the invention is to improve and to be compatible with existing disk scheduling schemes.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the present invention will be described in the following detailed disclosure, reference being made to the accompanying drawings, in which

Fig. 1 shows a schematic view of the memory handling principle according to an embodiment of the invention,

Fig. 2 illustrates in a flowchart a method according to an aspect of the invention,

Fig. 3 illustrates a portable streaming device according to another aspect of the invention, and

Fig. 4 shows a computer readable medium according to yet another aspect of the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

According to the invention, buffer size of the disk scheduling buffer is adaptively maximised in its size at all times. According to a preferred embodiment, a fixed size part of a scheduling buffer is provided, as in conventional schedulers, and an extra variable size part that adaptively changes in size depending on the availability of free solid state memory space in the portable streaming device. The fixed size part can be zero as well, whereby the device in this case only works with a variable memory part.

Fig. 2 illustrates in a flowchart a method 2 according to an aspect of the invention. In a portable streaming device, the size of a disk scheduler buffer memory is adaptively maximised within a memory in said portable streaming device. Free memory is in step 50 continuously allocated. In step 60, at least a portion of said allocated free memory is designated and used as disk scheduler buffer memory. The allocation is repeated continuously or terminated in step 70.

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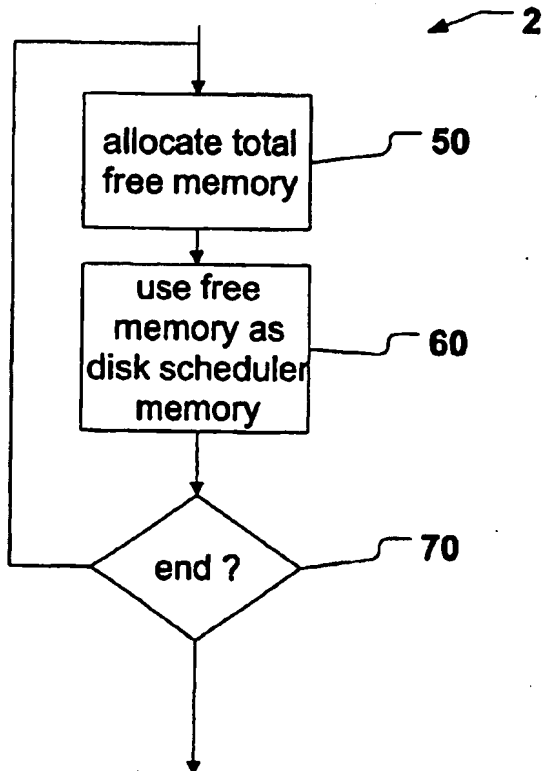NL-5656 AA Eindhoven (NL).

(54) Title: POWER SAVING METHOD FOR PORTABLE STREAMING DEVICES

(57) Abstract: A method (2) of controlling memory usage in a portable streaming device (100), a portable streaming device (100) and a computer readable medium (110). The portable streaming device (100) comprises at least one memory (102), at least one processing unit (101), and at least one storage device (103) being operatively connected with said memory (102) under control of said processing unit (101). The size of a disk scheduler buffer memory within said memory in said portable streaming device is adaptively maximised by said method (2) at all times. Free memory available within the portable streaming device is continuously allocated (50) and at least a portion of said allocated free memory is designated as disk scheduler buffer memory (60). Thus results improved solid state memory utilisation of the portable streaming device, and due to larger available disk buffer memory size, less start-stop-cycles of the storage device are initiated, which leads to a longer life-cycle of said portable streaming device.

WO 2004/057455 A2

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The total amount of solid state memory (e. g. DRAM or SRAM) available in a device is inherently limited and fixed in size and shared by a number of different components in the system. The scheduling buffer is only one of these, other users of the same memory pool are the application, operating system and possibly other internal devices in the system,

5   such as video codecs, connected to an internal bus. By allocating free memory space, i. e. memory currently not in use, to the disk scheduler buffer, the average scheduler buffer size is significantly increased leading to longer standby times of the bit engine and hence reduced power consumption and increased life-time. This leads as well to an improved solid state memory utilisation of the portable streaming device.

10   In typical mobile real-time applications, such as audio and/or video playback and/or recording, memory usage of non-scheduling tasks will be substantially stationary over time. In that situation the unused memory can easily be added to the scheduling buffers. As mobile infotainment devices are flexible devices that can execute a vast array of different applications, the available free memory is usually significant. The total available memory is

15   targeted at the most demanding application in terms of memory usage which generally is not play back or recording of video material.

Considering play back of encoded video in a non-limiting example, the total memory used for temporarily storing the uncompressed frames is often less than 8MB for standard definition video material. For a portable streaming device having typically 64MB of

20   total memory, given a fixed scheduler buffer size of e.g. 32MB, an extra 24MB of memory can be added to the buffer leading to a total scheduler buffer size of 56MB. This doubles almost the ratio between standby time and active time for this particular example of the invention, without any costly modification of the existing hardware, whereby the life cycle of the device is still almost doubled.

25   In case of multiple audio /video streams, such as with layered encoding formats, the available free solid-state memory is divided over multiple streams, whereby the memory is not necessarily distributed equally over the streams. Buffer sizes for each stream also depend on the bit-rate of the individual streams. Streams with lower bit-rates require smaller buffer sizes, hence available memory is preferably spent on high bit-rate streams. In

30   case applications which are running concurrently to the real-time streaming application, start requesting more memory, the scheduler buffer sizes can be gradually reduced to the original fixed size.

For applications or background tasks that are bursty in terms of memory usage, and which are running concurrently to the streaming application, a number of extra